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(54) **LOSS PREVENTION SYSTEM**

(75) Inventor: **Robert J. Wood**, Syracuse, NY (US)

(73) Assignee: **Welch Allyn, Inc.**, Skaneateles Falls, NY (US)

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(51) **Int. Cl.**
G08B 13/14 (2006.01)

(52) **U.S. Cl.**
USPC **340/568.1**; 340/571; 340/686.6

(58) **Field of Classification Search**
USPC 340/568.1, 571, 686.6
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,709,330	A	11/1987	Yokoi et al.	
5,801,627	A *	9/1998	Hartung	340/568.1
5,963,131	A	10/1999	D'Angelo et al.	
6,011,473	A	1/2000	Klein	
6,075,443	A	6/2000	Schepps et al.	
7,009,516	B2	3/2006	Enea	
7,471,203	B2	12/2008	Worthy et al.	
7,535,357	B2	5/2009	Enitan et al.	
7,696,871	B2	4/2010	Villiger	
7,864,049	B2 *	1/2011	Scott et al.	340/571
8,378,823	B2 *	2/2013	Eckert et al.	340/571
8,477,032	B2 *	7/2013	Bergman et al.	340/568.5
2003/0189488	A1	10/2003	Forcier et al.	
2005/0148339	A1	7/2005	Boman et al.	
2005/0285739	A1	12/2005	Velhal et al.	
2007/0186923	A1	8/2007	Poutiatine et al.	
2007/0229258	A1	10/2007	Villiger	
2009/0273485	A1	11/2009	Wike	

FOREIGN PATENT DOCUMENTS

CA	2331702	A1	9/2000
JP	2002507036	A	3/2002
KR	1020010071222	A	7/2001
WO	2009124108	A1	10/2009

OTHER PUBLICATIONS

International Search Report and Written Opinion in PCT/US2011/06119 mailed May 18, 2012, 8 pages.
Akass, Nio Portable Alarm, Sep. 17, 2009.
Vila, Infrared Protection System, Journal: Revista Espanola de Electronica, vol. 32, No. 367, p. 36-9, Spain, Jun. 1985.
Yang et al., EagleVision: A Pervasive Mobile Device Protection System, Iowa State Univ., Ames, IA, Jul. 2009.

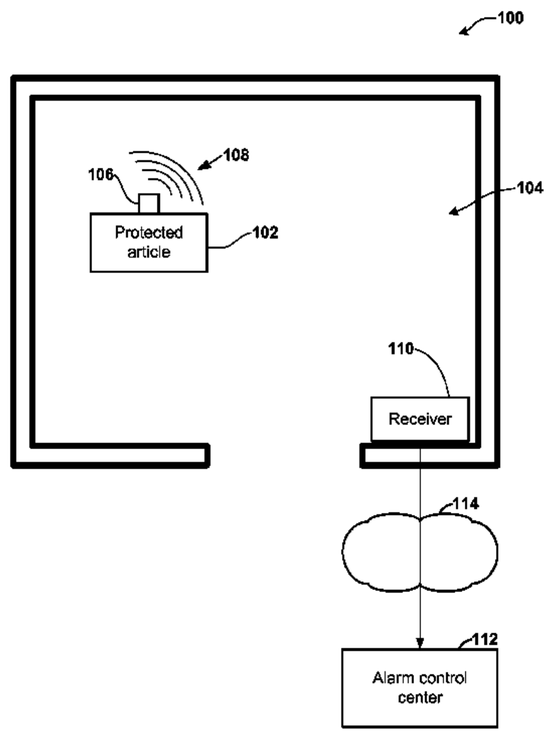
* cited by examiner

Primary Examiner — Toan N Pham
(74) *Attorney, Agent, or Firm* — Merchant & Gould P.C.

(57) **ABSTRACT**

A loss prevention system comprises a protected article and a receiver. The protected article and the receiver are located in the same room. The loss prevention system can help to prevent loss or theft of the protected article. The protected article comprises a transmitter that emits an infrared signal. The infrared signal has a carrier frequency that is modulated to encode a digital signature. The receiver detects infrared signals. The receiver performs an alarm action if the receiver does not detect within a rolling time window an infrared signal having the carrier frequency that is modulated to encode the digital signature.

18 Claims, 4 Drawing Sheets



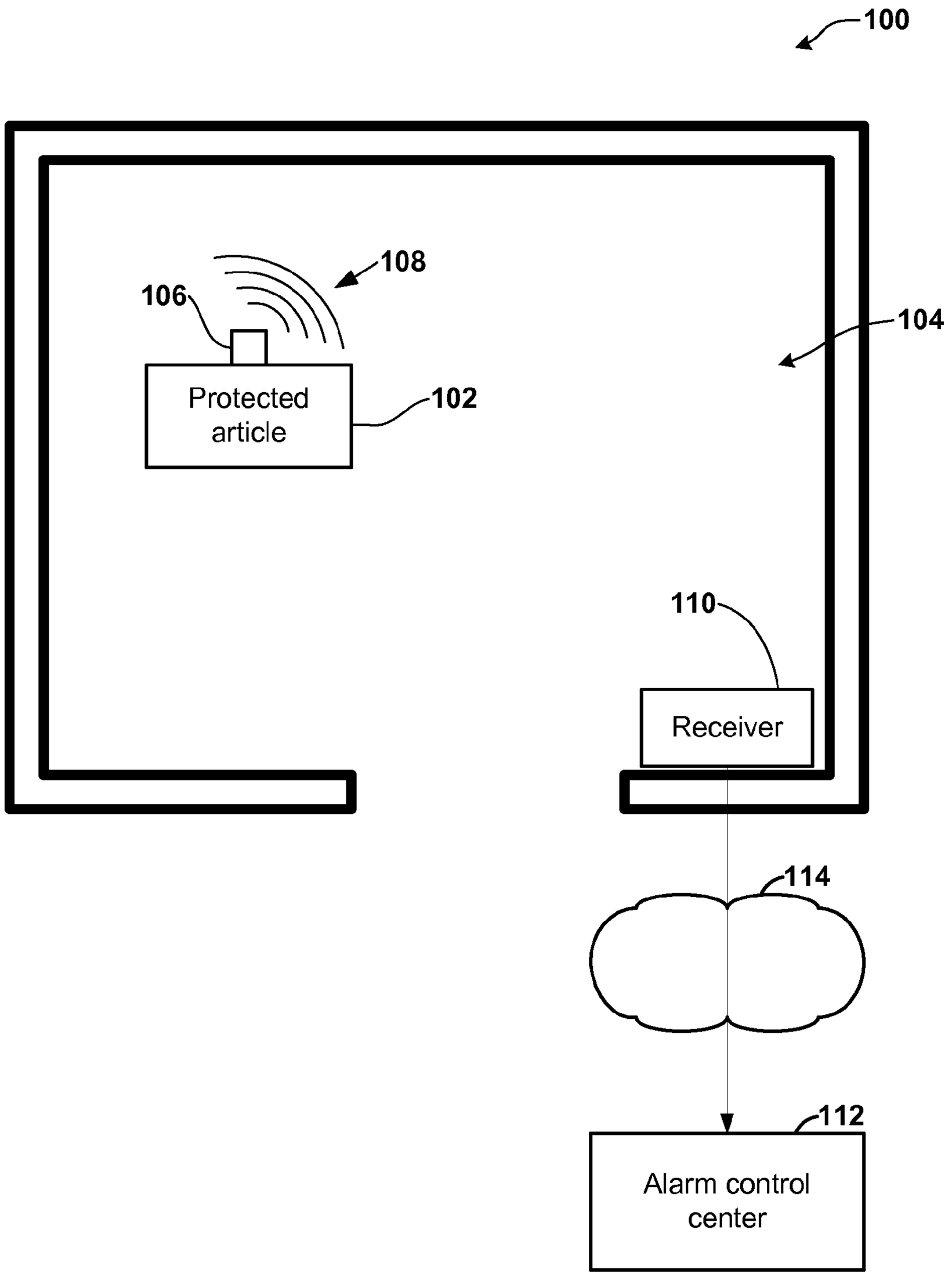

100
108
106
Protected article
102
104
110
Receiver
114
112
Alarm control center

FIG. 1

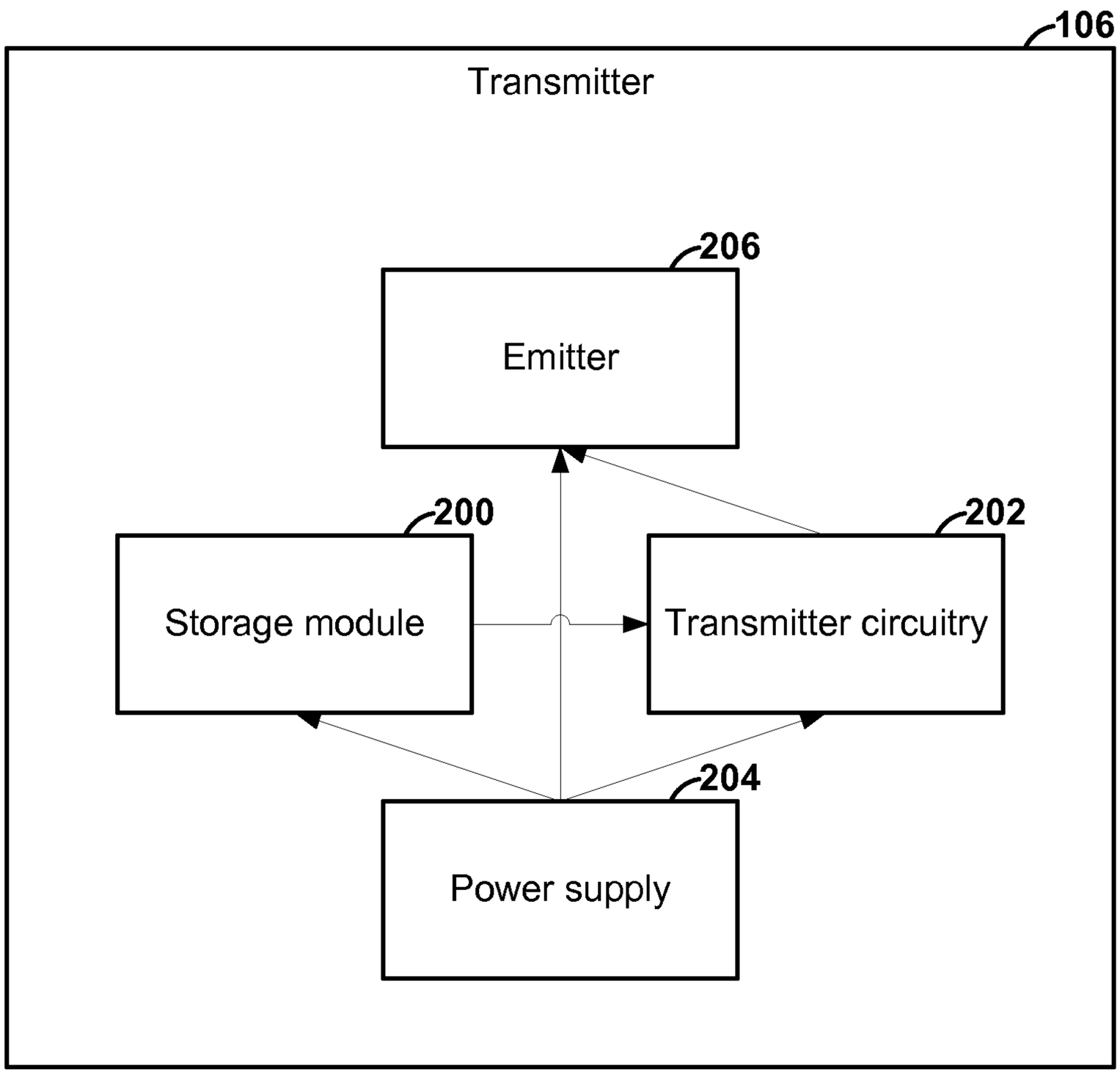

106
Transmitter
206
Emitter
200
Storage module
202
Transmitter circuitry
204
Power supply

FIG. 2

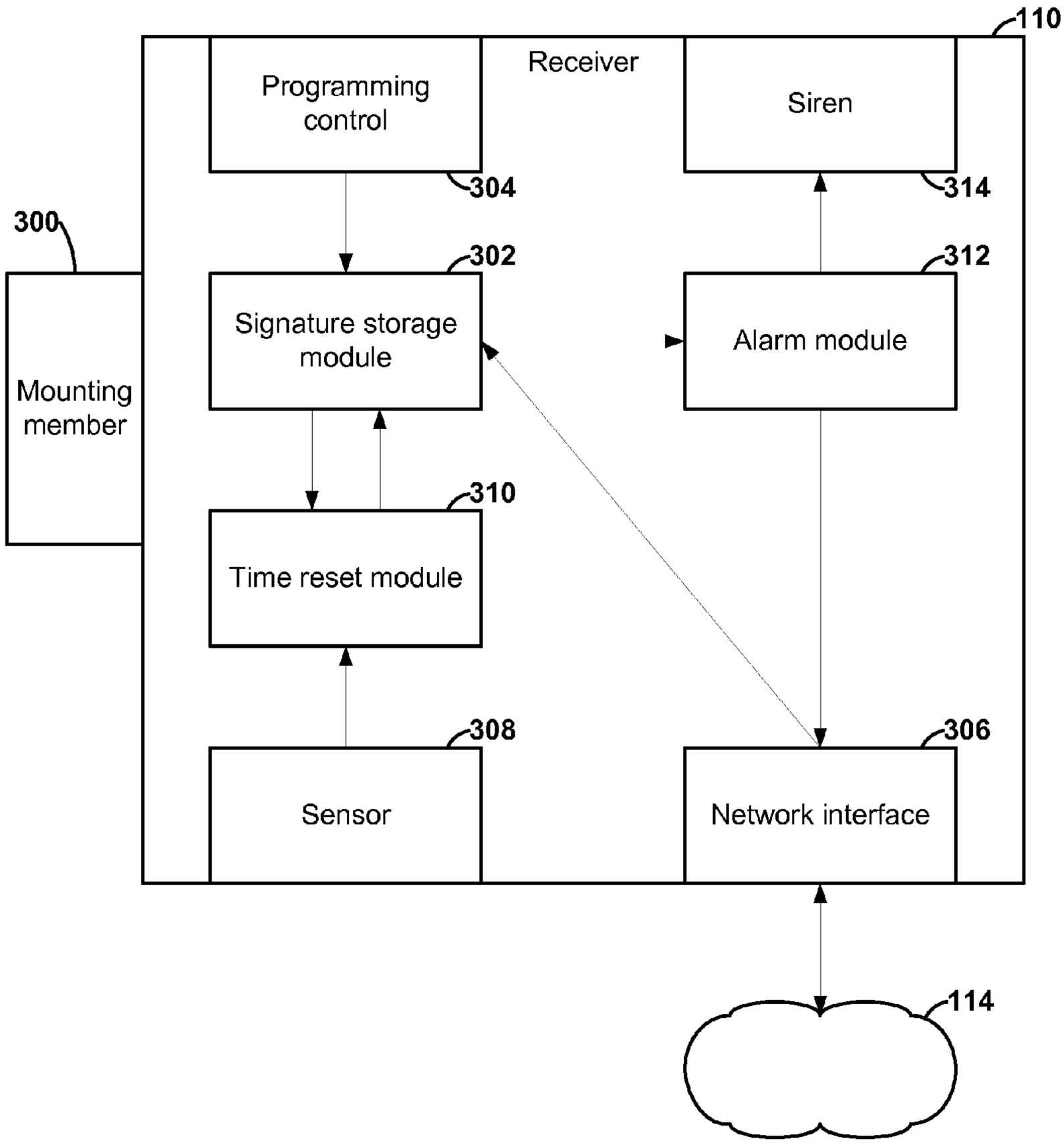

110
Receiver
Programming control
304
Siren
314
300
302
312
Signature storage module
Alarm module
Mounting member
310
Time reset module
308
306
Sensor
Network interface
114

FIG. 3

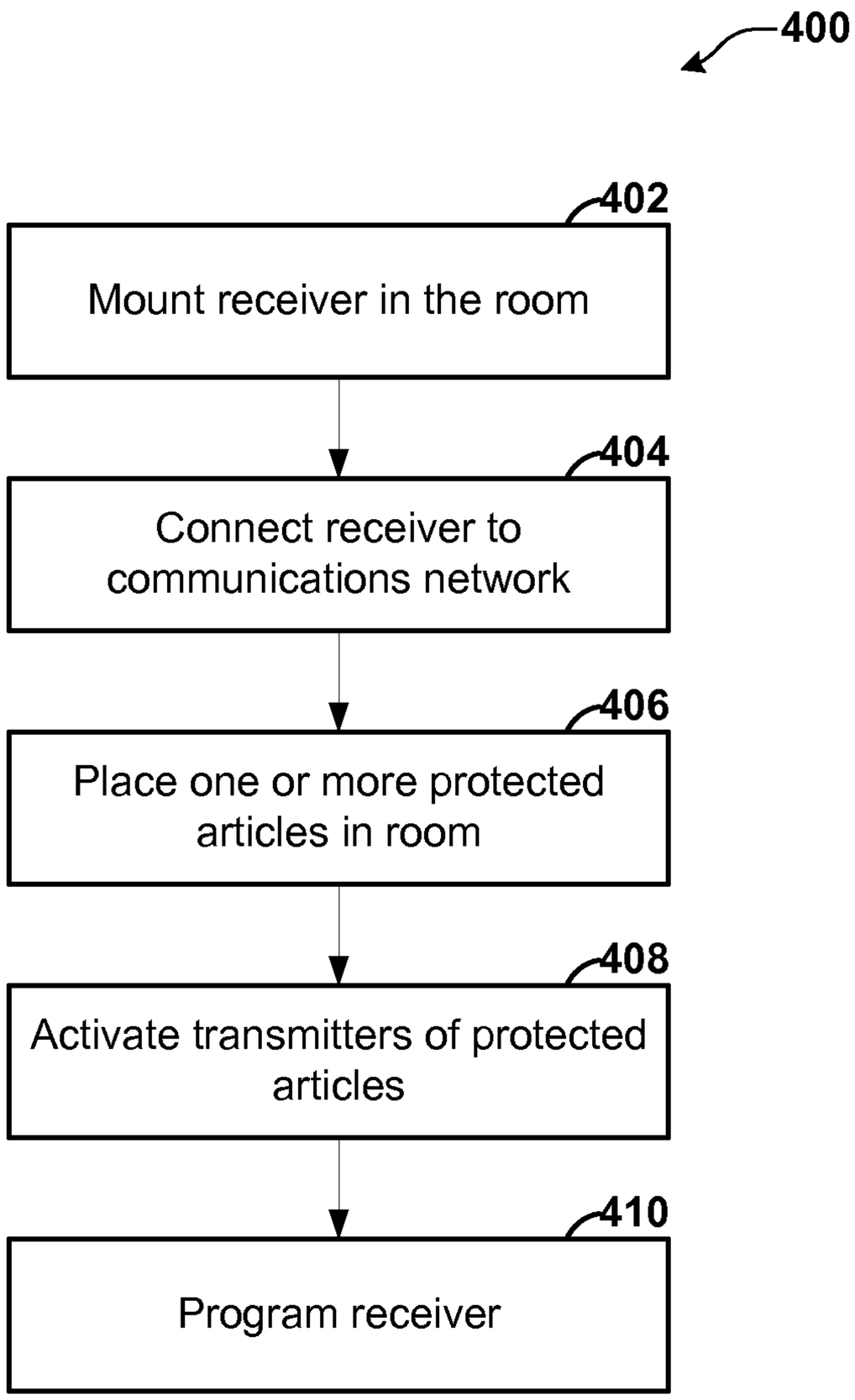

400
402
Mount receiver in the room
404
Connect receiver to communications network
406
Place one or more protected articles in room
408
Activate transmitters of protected articles
410
Program receiver

FIG. 4

LOSS PREVENTION SYSTEM

RELATED APPLICATION

This application claims the benefit of U.S. Patent Application Ser. No. 61/422,426 filed on Dec. 13, 2010, the entirety of which is hereby incorporated by reference.

BACKGROUND

Businesses frequently possess small valuable articles that are intended to remain in a single room for indefinite periods of time. For example, a doctor's office may keep a digital thermometer in an exam room. Unfortunately, it can be relatively easy for such articles to be lost. Such articles can be lost in various ways. For example, small valuable articles can be stolen or misplaced. For example, a person could steal a digital thermometer simply by putting the digital thermometer in a pocket and walking out of an exam room where the digital thermometer is meant to stay. In another example, a digital thermometer could easily become concealed in the bed linens of a patient's hospital room and be accidentally taken out of the hospital room when the bed linens are changed.

SUMMARY

A loss prevention system is provided. The theft and loss prevention system comprises a protected article and a receiver. The protected article and the receiver are located in the same room. The protected article comprises a transmitter that emits an infrared signal. The infrared signal has a carrier frequency that is modulated to encode a digital signature. The receiver detects infrared signals. The receiver performs an alarm action if the receiver does not detect within a rolling time window an infrared signal having the carrier frequency that is modulated to encode the digital signature.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an example embodiment of a loss prevention system.

FIG. **2** is a block diagram that illustrates example details of a transmitter in the loss prevention system.

FIG. **3** is a block diagram that illustrates example details of a receiver in the loss prevention system.

FIG. **4** is a flowchart that illustrates an example operation for installing the loss prevention system.

DETAILED DESCRIPTION

FIG. **1** illustrates an example embodiment of a loss prevention system **100**. As illustrated in the example of FIG. **1**, the loss prevention system **100** comprises a protected article **102**. The protected article **102** can be a wide variety of different types of articles. For example, the protected article **102** can be a portable medical device, such as a digital thermometer, a digital otoscope, a vital signs reader, a patient monitor, a set of surgical equipment, a set of dental tools, or another type of portable medical device. In another example, the protected article **102** can be a personal computer, a laptop computer, a tablet computer, a handheld computer, a computer peripheral device, a printer, a projector, a camera, a book, a safe, a tool, or another type of article.

The protected article **102** is located in a room **104**. The room **104** can be a variety of different types of room. For example, the room **104** can be a medical exam room, an operating room, a recovery room, an observation room, and/

or an intensive care unit room. In another example, the room **104** can be an office, a conference room, a hotel room, a bathroom, a workshop, a shed, or another type of room. The room **104** can be located inside a building.

The protected article **102** comprises a transmitter **106**. The transmitter **106** periodically emits an infrared signal **108**. The infrared signal **108** has a carrier frequency. In various embodiments, the infrared signal **108** has various carrier frequencies. For example, the infrared signal **108** can have a carrier frequency of 20 kHz.

The transmitter **106** modulates the carrier frequency of the infrared signal **108** to encode a digital signature into the infrared signal **108**. In this way, the infrared signal **108** carries the digital signature. The digital signature is a series of digits. In various embodiments, the digital signature can contain various numbers of digits. For example, the digital signature can be a series of 32 binary digits. In another example, the digital signature can be a series of 10 decimal digits.

The loss prevention system **100** also comprises a receiver **110**. The receiver **110** is mounted at a fixed position within the room **104**. The receiver **110** detects infrared signals, such as the infrared signal **108**. Because the infrared signal **108** is in the infrared part of the electromagnetic spectrum, the infrared signal **108** does not significantly penetrate the walls of the room **104**. Consequently, infrared detectors located outside the room **104** do not receive the infrared signal **108**. However, the infrared signal **108** tends to reflect off the walls of the room **104**. As a result, the receiver **110** can detect the infrared signal **108** even if there is not a direct line of sight between the protected article **102** and the receiver **110**.

The receiver **110** stores one or more digital signatures. For example, the receiver **110** can store the digital signature of the transmitter **106**. Each of the digital signatures is associated with a time window. In various embodiments, the timer windows have various lengths. For example, the timer windows can have lengths of ten seconds. In another example, the timer windows can have lengths of twenty seconds. When the receiver **110** detects an infrared signal having the carrier frequency, the receiver **110** determines whether the infrared signal carries one of the digital signatures. If the receiver **110** determines that the infrared signal carries one of the digital signatures, the receiver **110** resets a time window for the digital signature.

The receiver **110** performs an alarm action if the receiver **110** does not detect an infrared signal that carries the digital signature within the time window for the digital signal. For example, the time window for a given digital signature can be ten seconds. In this example, the receiver **110** performs an alarm action if the receiver **110** does not receive an infrared signal that carries the given digital signature within ten seconds of a most recent time that the receiver **110** received an infrared signal that carried the given digital signature.

In various embodiments, the receiver **110** can perform various alarm actions. For example, performing the alarm action can comprise emitting an audible alarm, such as a siren. In another example, performing the alarm action can comprise flashing a light. In the example of FIG. **1**, the loss prevention system **100** comprises an alarm control center **112**. In the example of FIG. **1**, performing the alarm action comprises sending an alarm signal from the receiver **110** to the alarm control center **112** via a communications network **114**.

The alarm control center **112** comprises one or more physical locations where people and/or computing devices receive alarm signals and determine how to respond to the alarm signals. In different embodiments, the alarm control center **112** can be in a different building than the room **104** or the

same building as the room **104**. The alarm control center **112** can be operated by an entity that uses the room **104** or by a third party service provider. The communications network **114** can comprise various types of communications networks, such as a public-switched telephone network, a wireless computer networking network, a wired broadband network connection, the Internet, a local-area network, or another type of communications network.

FIG. **2** is a block diagram that illustrates example details of the transmitter **106** in the loss prevention system **100**. In various embodiments, the protected article **102** may or may not be designed for use with the transmitter **106**. For example, the protected article **102** can be originally designed and manufactured to include the transmitter **106**. In another example, the protected article **102** can be originally designed to be used with the transmitter **106** and the transmitter **106** is added to the protected article **102** after the protected article **102** is initially sold. In yet another example, the protected article **102** is not originally designed to be used with the transmitter **106**.

In various embodiments, the transmitter **106** can be attached to the protected article **102** in various ways. For example, the transmitter **106** can be incorporated within an exterior housing of the protected article **102**. In another example, the transmitter **106** can be attached to an exterior of the protected article **102** with an adhesive, screws, bolts, rivets, welds, tape, or other fasteners.

As illustrated in the example of FIG. **2**, the transmitter **106** comprises a storage module **200**, transmitter circuitry **202**, a power supply **204**, and an emitter **206**. The storage module **200** stores a digital signature. In various embodiments, the digital signature can become stored in the storage module **200** in various ways. For example, the digital signature can be hard coded into the circuitry in the storage module **200**. In another example, the storage module **200** is an electrically-erasable programmable read-only memory (EEPROM). In this example, the digital signature can be stored onto the storage module **200** when the transmitter **106** is manufactured, or afterward. In some embodiments where the digital signature is stored onto the storage module **200** when the transmitter is manufactured, each different transmitter made by a given manufacturer stores a unique digital signature. In other embodiments where the digital signature is stored onto the storage module **200** when the transmitter is manufactured, transmitters for different product types have different digital signatures, but transmitters for the same product type have the same digital signature. In another example, an end user of the protected article **102** can store the digital signature on the storage module **200**.

The transmitter circuitry **202** retrieves the digital signature from the storage module **200** and outputs electrical signals to the emitter **206**. The electrical signals cause the emitter **206** to emit the infrared signal **108**. In some embodiments, the emitter **206** emits the infrared signal **108** in all directions. In other embodiments, the emitter **206** emits the infrared signal **108** in only some directions. As discussed above, the infrared signal **108** has a carrier frequency that is modulated to encode the digital signature stored in the storage module **200**.

In various embodiments, the transmitter circuitry **202** outputs electrical signals that cause the emitter **206** to emit the infrared signal **108** at various intervals. For example, the transmitter circuitry **202** can cause the emitter **206** to emit the infrared signal **108** once every second. In another example, the transmitter circuitry **202** can cause the emitter **206** to emit the infrared signal **108** once every three seconds.

The power supply **204** provides electrical power to the storage module **200**, the transmitter circuitry **202**, and the emitter **206**. In various embodiments, the power supply **204** is implemented in various ways. For example, the power supply **204** can be implemented as a rechargeable battery. In this example, the rechargeable battery can be separate from the main power supply of the protected article **102**. In another example, the power supply **204** can be the main power supply of the protected article **102**. The main power supply of the protected article **102** can be a battery or a main power supply of a building that contains the room **104**.

FIG. **3** is a block diagram illustrating example details of a receiver **110**. As illustrated in the example of FIG. **3**, the receiver **110** has a mounting member **300**. The mounting member **300** acts to mount the receiver **110** at a stationary location within the room **104**. In various embodiments, the mounting member **300** can have various forms. For example, the mounting member **300** can be a bracket that mounts the receiver **110** to a wall of the room **104**. In another example, the mounting member **300** can be a portion of an exterior housing of the receiver **110** that defines a loop through which a screw, nail, or other fastener can pass. This fastener is attached to a wall or other surface in the room **104**. In yet another example, the mounting member **300** is a flat area in the exterior housing of the receiver **110**. In this example, the flat area of the external housing can help the receiver **110** rest stably on a flat surface within the room **104**.

Furthermore, the receiver **110** comprises a signature storage module **302**. The signature storage module **302** stores one or more digital signatures. In various embodiments, the signature storage module **302** is implemented in various ways. For example, the signature storage module **302** can be implemented as an EEPROM, a solid state memory module (e.g., a Flash memory unit), or another type of computer-readable storage medium.

In various embodiments, the digital signatures can be stored onto the signature storage module **302** in various ways. For example, the receiver **110** can comprise a programming control **304** as shown in FIG. **3**. When a user of the receiver **110** activates the programming control **304**, the signature storage module **302** stores the digital signatures carried by each infrared signal detected by the receiver **110** within a given time period. Thus, when the user installs the receiver **110** in the room **104**, the user can activate the programming control **304** to cause the receiver **110** to start expecting to detect infrared signals carrying the digital signatures of each protected article in the room **104**.

In various embodiments, the user can activate the programming control **304** in various ways. For example, the programming control **304** can be a button. In this example, the user activates the programming control **304** by pressing on the programming control **304**. In another example, the programming control **304** can be a switch. In this example, the user activates the programming control **304** when the user flips the switch.

In another example, the receiver **110** can comprise a network interface **306** as shown in FIG. **3**. The network interface **306** is a device that enables the receiver **110** to communicate with other computing devices via the communications network **114**. In this example, the network interface **306** receives digital signatures from another computing device via the communications network **114**. For instance, the network interface **306** can receive the digital signatures from a computing device at the alarm control center **112**. When the network interface **306** receives a digital signature, the signature storage module **302** stores the digital signature.

In other embodiments, digital signatures can be stored onto the signature storage module **302** in other ways. For example, the receiver **110** can comprise a keypad (not shown). In this

example, the signature storage module **302** stores digital signatures entered by a user via the keypad.

The signature storage module **302** also stores time data associated with each of the digital signatures stored in the signature storage module **302**. In various embodiments, the time data have various forms. For example, the time data associated with a digital signature can indicate a last time that the receiver **110** detected an infrared signal that carries the digital signature. In another example, the time data associated with a digital signature indicates a time before which the receiver **110** must receive an infrared signal carrying the digital signature to prevent the receiver **110** from performing an alarm action. In yet another example, the time data associated with a digital signature can count up the amount of time that has passed after the receiver **110** last received an infrared signal carrying the digital signature.

Furthermore, the receiver **110** comprises a sensor **308**. The sensor **308** detects infrared signals, such as the infrared signal **108**. When the sensor **308** detects an infrared signal, the sensor **308** outputs an electrical signal to a time reset module **310** within the receiver **110**. In various embodiments, the electrical signal encodes different information about the infrared signal. For example, the electrical signal outputted by the sensor **308** can have a voltage waveform that represents the modulated carrier frequency of the infrared signal. In another example, the sensor **308** can demodulate the carrier frequency. In this example, the electrical signal outputted by the sensor **308** can have a voltage waveform that represents information modulated onto the carrier frequency.

The time reset module **310** determines whether the information carried by the detected infrared signal (i.e., the information modulated onto the carrier frequency of the infrared signal) is one of the digital signatures stored in the signature storage module **302**. To determine whether the information carried by the detected infrared signal is one of the digital signatures stored in the signature storage module **302**, the time reset module **310** reads the digital signatures from the signature storage module **302**.

If the time reset module **310** determines that the information carried by the detected infrared signal is a given one of the stored digital signatures, the time reset module **310** resets the time window associated with the given digital signature. In various embodiments, the time reset module **310** resets the time window associated with the given digital signature in various ways. For example, the time reset module **310** can store time data indicating a current time into the signature storage module **302**. In another example, the time reset module **310** can store time data that indicates a time before which the receiver **110** must receive an infrared signal carrying the digital signature to prevent the receiver **110** from performing an alarm action.

The receiver **110** also comprises an alarm module **312**. The alarm module **312** determines whether the receiver **110** has detected infrared signals carrying the stored digital signatures within the time windows for the stored digital signatures. In various embodiments, the alarm module **312** determines in various ways whether the receiver **110** has detected an infrared signal carrying a given one of the digital signatures within a time window for the given digital signature. For example, the signature storage module **302** can store a time data that indicates a last time that the receiver **110** detected an infrared signal carrying the given digital signature. In this example, the alarm module **312** determines whether an amount of time between the current time and the time indicated by the time data is greater than the time window for the given digital signature. In another example, the signature storage module **302** can store time data that indicates a time before which the receiver **110** must detect another infrared signal carrying the digital signature. In this example, the alarm module **312** determines whether a current time is after the time indicated by the time data.

If the alarm module **312** determines that the receiver **110** has not detected an infrared signal carrying a given one of the stored digital signatures within the time window for the given digital signature, the alarm module **312** performs an alarm action. In various embodiments, the alarm module **312** can perform various alarm actions. For instance, in the example of FIG. **3**, the receiver **110** comprises a siren **314**. When the alarm module **312** performs an alarm action, the alarm module **312** can output electrical signals that cause the siren **314** to emit an audible sound. Furthermore, when the alarm module **312** performs an alarm action, the alarm module **312** can cause the network interface **306** to send an alarm message to a computing device in the alarm control center **112** via the communications network **114**.

The time reset module **310**, the alarm module **312**, and the network interface **306** can be implemented in various ways. For example, the time reset module **310**, the alarm module **312**, and/or the network interface **306** can be comprise one or more integrated circuits. In another example, the time reset module **310**, the alarm module **312**, and/or the network interface **306** can comprise one or more circuits laid out on a circuit board.

FIG. **4** is a flowchart illustrating an example operation **400** for installing the loss prevention system **100**. As illustrated in the example of FIG. **4**, the operation **400** begins when an installer mounts the receiver **110** in the room **104** (**402**). As discussed above, the installer can mount the receiver **110** in the room **104** in various ways. After the installer mounts the receiver **110** in the room **104**, the installer connects the receiver to the communications network **114** (**404**). In various embodiments, the installer can connect the receiver to the communications network **114** in various ways. For example, the installer can plug a network cable into the receiver **110**. In another example, the installer can configure the receiver **110** to use a wireless signal to connect to the communications network **114**.

Furthermore, the installer places one or more protected articles (e.g., the protected article **102**) in the room **104** (**406**). Each of the protected articles has a transmitter that emits infrared signals that carry digital signatures. After the installer places the protected articles in the room **104**, the installer activates the transmitters of the protected articles (**408**). In various embodiments, the installer can activate the transmitters in various ways. For example, the installer can activate the transmitters using on/off switches on the transmitters. In another example, the installer can activate the transmitters by installing batteries in the transmitters. In yet another example, the installer can activate the transmitters by connecting the power supplies of the transmitters to main power supplies of the protected articles.

The installer can then program the receiver **110** to perform alarm actions if the receiver **110** does not detect within rolling time windows infrared signals having carrier frequencies that are modulated to encode the digital signatures of the transmitters (**410**). As discussed above, the receiver **110** can be programmed in various ways.

The various embodiments described above are provided by way of illustration only and should not be construed as limiting. Those skilled in the art will readily recognize various modifications and changes that may be made without following the example embodiments and applications illustrated and described herein. For example, the operations shown in the figures are merely examples. In various embodiments,

similar operations can include more or fewer steps than those shown in the figures. Furthermore, in other embodiments, similar operations can include the steps of the operations shown in the figures in different orders.

What is claimed is:

1. A loss prevention system comprising:

a protected article comprising a transmitter that emits an infrared signal, the infrared signal having a carrier frequency that is modulated to encode a digital signature, the protected article being located in a room; and

a receiver that detects infrared signals, the receiver mounted at a fixed position within the room, the receiver performing an alarm action if the receiver does not detect within a rolling time window an infrared signal having the carrier frequency that is modulated to encode the digital signature; and

a second protected article, the second protected article comprising a second transmitter that emits a second infrared signal, the second infrared signal having a second carrier frequency that is modulated to encode a second digital signature, the second protected article located in the room;

wherein the receiver performs the alarm action if the receiver does not detect within a second rolling time window an infrared signal having the second digital signature.

2. The loss prevention system of claim **1**, wherein the receiver draws power from a main power supply of a building that contains the room.

3. The loss prevention system of claim **1**, wherein the alarm action comprises emitting an audible alarm.

4. The loss prevention system of claim **1**, wherein the alarm action comprises sending an alarm message to an alarm control center.

5. The loss prevention system of claim **4**, wherein the receiver sends the alarm message to the alarm control center via a communications network.

6. The loss prevention system of claim **4**, wherein the room is in a first building and the alarm control center is in a second building.

7. The loss prevention system of claim **4**, wherein a person or computing device at the alarm control center determines how to respond to the alarm message.

8. The loss prevention system of claim **1**, wherein after the receiver is mounted in the room, an end user programs the receiver to perform the alarm action if the receiver does not detect within the rolling time window the infrared signal having the carrier frequency that is modulated to encode the digital signature.

9. The loss prevention system of claim **8**, wherein the receiver comprises a programming control, wherein after the end user activates the programming control, the receiver detects a set of infrared signals over a given time period and subsequently performs alarm actions when the receiver does not detect infrared signals having digital signatures of the set of infrared signals.

10. The loss prevention system of claim **8**, wherein the receiver receives the digital signature from a computing device via a communications network.

11. The loss prevention system of claim **1**, wherein the transmitter draws power from a main power supply of the protected article.

12. The loss prevention system of claim **1**, wherein the transmitter draws power from a rechargeable battery that is separate from a main power supply.

13. The loss prevention system of claim **1**, wherein the transmitter is programmed with the digital signature when the transmitter is manufactured.

14. The loss prevention system of claim **1**, wherein the digital signature is a sequence of digits.

15. A method of installing a loss prevention system, the method comprising:

placing a protected article in a room, the protected article comprising a transmitter that emits an infrared signal, the infrared signal having a carrier frequency that is modulated to encode a digital signature;

mounting a receiver in the room, the receiver detecting infrared signals, the receiver mounted at a fixed position within the room, the receiver performing an alarm action if the receiver does not detect within a rolling time window an infrared signal having the carrier frequency that is modulated to encode the digital signature;

placing a second protected article in the room, the second protected article comprising a second transmitter that emits a second infrared signal, the second infrared signal having the carrier frequency, the carrier frequency modulated to encode a second digital signature; and

performing by the receiver, the alarm action if the receiver does not detect within a second rolling time window an infrared signal that carries the second digital signature.

16. The method of claim **15**, further comprising: after mounting the receiver in the room, programming the receiver to perform the alarm action when the receiver does not detect within the rolling time window the infrared signal having the carrier frequency that is modulated to encode the digital signature.

17. The method of claim **15**,

wherein the method further comprises connecting the receiver to a communications network; and

wherein the alarm action comprises sending an alarm message to an alarm control center via the communications network.

18. A method of installing a loss prevention system, the method comprising:

placing a protected article in a room, the protected article comprising a transmitter that emits an infrared signal, the infrared signal having a carrier frequency that is modulated to encode a digital signature;

mounting a receiver in the room, the receiver detecting infrared signals, the receiver mounted at a fixed position within the room, the receiver performing an alarm action if the receiver does not detect within a rolling time window an infrared signal having the carrier frequency that is modulated to encode the digital signature;

after mounting the receiver in the room, programming the receiver to perform the alarm action when the receiver does not detect within the rolling time window the infrared signal having the carrier frequency that is modulated to encode the digital signature;

placing a second protected article in the room, the second protected article comprising a second transmitter that emits a second infrared signal, the second infrared signal having the carrier frequency, the carrier frequency modulated to encode a second digital signature, wherein the receiver performs the alarm action if the receiver does not detect within a second rolling time window an infrared signal that carries the second digital signature;

connecting the receiver to a communications network; and

sending an alarm message to an alarm control center via the communications network.

* * * * *